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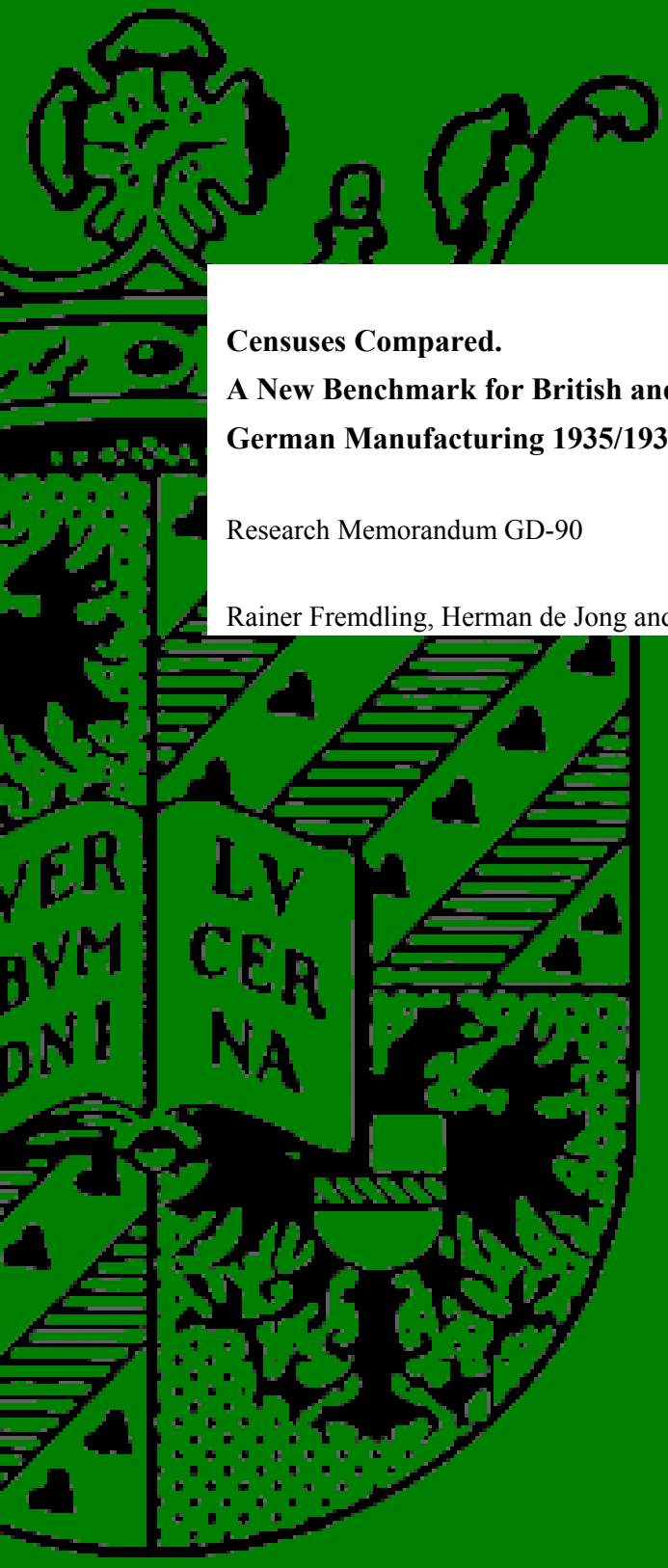

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Research Memorandum GD-90

Rainer Fremdling, Herman de Jong and Marcel P. Timmer

RESEARCH MEMORANDUM

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Abstract
We present a new estimate of Anglo-German manufacturing output and productivity levels by industry for 1935/36. It is based on newly explored archival data on German manufacturing together with published British census data. We calculate comparative levels of value added, correcting for differences in prices for outputs and inputs. This so-called double deflation procedure provides new insights into productivity comparisons because output- and input price structures differed greatly between the two countries. Although the new calculations confirm existing results at an aggregate level, they reveal important differences at the industry level and show how Germany was striving for autarky as it prepared its economy for war.

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1. Introduction

Studies of comparative economic performance of nations have a long history. The best-known comparison of long-run productivity performance is the work of Angus Maddison (1995, 2001). It is characterized by the wide coverage in terms of countries and time-span, the use of a transparent methodology and the exclusive reliance on national time-series produced by statistical offices or researchers of these countries. National income and output series at constant prices are tied together at a certain benchmark year in order to compare the long-run trends in GDP per capita. Maddison based his comparative efforts on benchmark estimates of real GDP for a single benchmark year, using 1990 Purchasing Power Parities (PPPs).[1] It is well known that problems of interpretation arise, when time-series of different origin are projected from a benchmark into distant periods. But they serve as a first proxy and establish a point of departure for further research. Indeed, these so-called "long-span projections" have recently been increasingly criticized through confrontations with new benchmark studies for earlier years or new PPP estimates.[2] This raised the issue of comparability between benchmark estimates of real GDP and national time series. The same issue was also at the heart of a recent debate between Marianne Ward and John Devereux, and Stephen Broadberry in *The Journal of Economic History*.[3]

We believe that three important lessons can be learnt from the recent debates on long-run comparative productivity performance. First, the need for more benchmark studies to cross-check "long-span projections". Second, the need to attempt the reconciliation of benchmark estimates and national time-series on real GDP in which both benchmark and time-series are scrutinised.[4] Third, there's a renewed interest in benchmarks based on the industry-of-origin approach as important cross-checks for expenditure-based GDP comparisons.[5] Industry-of-origin studies focus on comparisons of output and productivity in sectors such as agriculture, manufacturing and services. They furnish valuable insights into comparative economic structures and relative productivity at a detailed level. And aggregated over all sectors they provide an independent estimate of real GDP.

In this paper we provide a new industry-of-origin study of output and productivity in manufacturing industries in Germany compared to the United Kingdom for the years 1936 and 1935 respectively. This comparison is made on the basis of double deflated value added, using separate output and intermediate input prices for deflation.[6] It is widely acknowledged that double deflation is the

[1] For most countries 1990 PPPs are used, but for some PPPs from a year close to 1990 (see Maddison, *World Economy*, for details).
[2] Prados de la Escosura, " International Comparisons"; Van Zanden, "Rich and Poor".
[3] Ward and Devereux, "Measuring British Decline"; Broadberry, "Relative Per Capita Income"; Ward and Devereux, "Relative U.K./U.S. Output".
[4] See e.g. Ritschl, "Spurious Growth."; Broadberry and Burhop, "Comparative Productivity"
[5] This was first proposed in the study by Paige and Bombach, *Comparison*, see also Broadberry, "Relative Per Capita Income Levels"; Ward and Devereux, "Measuring British Decline".
[6] "Value added" is sometimes denoted by "net production value" but we prefer the former term as it is consistent with the terminology in the System of National Accounts. In addition, we use the term deflation for both intertemporal and interspatial comparisons.

preferred approach for sector comparisons of output and productivity since it takes into account relative prices for intermediate inputs, alongside relative prices for gross output.[7]

Existing international comparisons of productivity in manufacturing for the pre-WWII period relied either on direct quantity comparisons or on single deflation, using relative output prices to convert value added into a common set of prices.[8] For example, Stephen Broadberry and Rainer Fremdling reworked a Germany-UK comparison for 1935 by Laszlo Rostas, which was mainly based on physical quantities. The primary obstacle for double deflation has been the paucity of comparative price data on intermediate inputs, such as materials, energy and services. In recent years, however, the archival records that formed the basis of the published version of Germany's 1936 industrial census have been rediscovered.[9] As early as in the 1940s, Rostas knew what such archival material would make possible. In his comparison of Germany and the UK, he remarked that "… a revision of these figures could be undertaken when the detailed reports of the 1936 German census of production become available in this country."[10] In the 1990s the underlying data records (*Produktionserhebungen*) of the German census of 1936 were finally found in the *Bundesarchiv* in Berlin. The reunification of German archives has offered historians easier access to the records of the Imperial Statistical Office (*Statistisches Reichsamt*), which is now housed in Berlin-Lichterfelde (West). This new information from the German industrial census of 1936 not only permits a reevaluation of German growth in the twentieth century but also makes possible a more careful comparison of British and German industrial productivity in the interwar years. These data allow us to make the new comparison of British and German manufacturing in 1935/36, which differs from the existing estimates in three ways. First, the newly available data let us to calculate value added and labor productivity for 109 industries in Britain and Germany, covering the entire manufacturing sector. Second, we can convert everything into a common currency by using price ratios derived for each industry in Britain and Germany from data on quantities and values of gross output. Third, the available data on intermediate input items make it possible to adjust for intermediate input price levels as well and to carry out a double deflation analysis in a clearly defined conceptual framework.

[7] See for example Paige and Bombach, *Comparison*, p. 82. Although the authors advocated the methodology of double deflation, in practice they did not implement it in manufacturing. See also Broadberry, *Productivity Race*, p. 23. Since long, double deflation has been the standard procedure for measuring volume changes in value added over time by statistical offices.

[8] See Broadberry and Fremdling, "Comparative Productivity"; Broadberry, "Anglo-German Productivity Differences" for UK-Germany comparisons. Other comparisons will be discussed below.

[9] Reichsamt, *Die deutsche Industrie.*

[10] Rostas, *Comparative Productivity*, p. 40.

2. Sources and data

In general, production censuses provide the best data for productivity comparisons. Based on one and the same source, they give information on gross output (quantities and values of products), value added, and employment, which guarantees internal consistency. For the United Kingdom, we took the *Census of Production* of 1935, which was published by the Business Statistics Office (BSO) of the Board of Trade.[11] The data on Germany are based on the industrial census of 1936. One well-known disadvantage of using census data is that production censuses often omit production data from smaller firms. If the omissions are more severe in one country, comparisons involving it may be inconsistent. Countries may also differ in their definition and concepts of gross output, intermediate input and employment. In this section, we provide a rough estimation of possible differences in coverage and concepts between the German and British censuses.

In this study, we do not draw on the *published* version of the German census but on the comprehensive *archival records* of the German data. We do so for four reasons. First, for military reasons, some branches of industry were hidden by classifying them under misleading headings or by applying a high level of aggregation in the official publication. Second, the archival records give more detailed information on a lower level of aggregation, which makes it easy to fit the German industries into the classifications used in the UK census. Third, the published German census provides labor force data only for a single month of the year (usually June), whereas the archival records give the same information for two months (usually June and December). The archival records thus permit precise estimates of labor input and labor productivity. Finally, the archival records provide detailed accounts of the quantities and related values of inputs and outputs for many different manufacturing industries. This allows us to calculate average unit values for a large number of items, which a robust comparison with the UK requires. Because of these characteristics of the unpublished archival records we believe the figures on Germany that we present in this paper are superior to the official census figures published in 1939. Before starting with the comparison of data from this source with the British census of 1935, we will describe the historical background of the German industrial census of 1936, its publication in 1939, and the archival records in some detail.

The German industrial census of 1936 and its publication in 1939

In 1939, the German Imperial Office for Military-Economic Planning (*Reichsamt für Wehrwirtschaftliche Planung*) published its first and only report on the official Census of Production: *Gesamtergebnisse der amtlichen Produktionsstatistik – Die deutsche Industrie*.[12] At first sight, it seems both comprehensive and detailed and seemingly covers all of German industry, with 30 industrial branches and a number of sub-branches. In addition to value added, it offers information on employment, wage bills, sales, and foreign trade.[13]

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[11] Board of Trade, *Final Report*.

[12] Formerly it was the department of industrial statistics of the Imperial Statistical Office (Statistisches Reichsamt). Renamed as Reichsamt für Wehrwirtschaftliche Planung it became an independent institution in 1938. Tooze, *Statistics,* p. 222.

[13] For a thorough description see Fremdling, ”German Industrial Census”; Fremdling and Stäglin, “Industrieerhebung.”

Surprisingly, the report admits that the industrial census of 1936 was used for planning the war. With this in mind, one wonders why the German Imperial Office published the information at all. Such a publication was not undisputed of course. The central command of the army accused the Imperial Office of having violated secrecy by publishing the report. It demanded that the data be removed from public access.[14] Although publication of statistics was restricted, the Imperial Ministry of Economics had approved the report, since it fell within the guideline of what was permissible. This guideline did not recommend that data be deliberately falsified. On the contrary, in February 1939 it was stipulated: "… all publications should still tell the truth. In case of doubt, the publication of statistical and other details should be dropped rather than to report wrong details."[15]

A comparison of the published data of the Imperial Office with the records reveals that the published data seem to be reliable, at least at first glance. For reasons of camouflage, however, certain industries considered important for warfare were hidden by the way the data were aggregated. Basically, the data had been collected for individual plants or industrial units (*Betriebsstätten*). They then were aggregated by industrial branch. For the sensitive iron and steel industries, for instance, the published statistics covered the entire branch, whereas the archival records distinguished four separate industries. For chemicals, the publication distinguished only seven industries, whereas 38 were noted in the archival records. In addition, certain industries were hidden under misleading aggregates. The foremost example is the aircraft industry. It was supposed to fall under the category of 'vehicles' (*Fahrzeugindustrie*) but it ended up hidden under 'construction and others' (*Bauindustrie und sonstige Industriezweige*). As early as in 1936, aircraft industry employed at least 135,210 people.[16] This means eighty percent of the published work force (166,534) for vehicles. A similar camouflage was applied to other industries that were considered to have military importance.[17] Due to shifts among industrial branches, notably fuel production, we found further deviations from the published figures in other sectors as well. These are documented in a preliminary input-output table for 1936 covering 16 out of 30 branches of industry.[18] This finding casts more doubt on Walther Hoffmann's reconstruction of German national accounts: For his indices of industrial production and handicraft, he used the published value added figures (*Nettoproduktionswerte*) of the 1936-census as weights in order to compile the aggregate index for the entire time-span from 1850 to 1959.[19]

[14] Bundesarchiv [hereafter BA] R 3102 / 3082 (letter of 18 August 1939), answers by Leisse 25 August 1939.
[15] BA R 3102 / 3082 F 9. The Imperial Office had planned further publications.
[16] BA R 3102 / 5922. In BA R 3102 / 5866 even higher employment data are reported.
[17] These data concern stocks in cotton industry,"Zündererzeugung" (BA R 3102 / 3082 F37, 30.8.1939), "Schusswaffenindustrie", "Herstellung von Zündstoffen und Sprengkapseln" and "Sprengstoffindustrie". See also Sleifer, "Separated Unity".
[18] Fremdling, "German Industrial Census," pp. 162-5.
[19] Hoffmann, *Wachstum,* p. 389.

Comparison of the German and the UK censuses

The starting point for our comparison is the classification of the British *Census of Production*.[20] We concentrate on manufacturing, excluding mining, construction works, public utilities, and government industries. For Germany, we draw on the unpublished figures gathered by the Imperial Statistical Office. We arranged the industries into a common classification suitable for a full comparison. The detailed categories in the German archival records allowed us to match each German industry with a corresponding British counterpart. The British census lists 109 separate manufacturing industries or trades. The 284 industries of the German census, covering all manufacturing, were assigned accordingly.[21]

The area covered by the British census is Great Britain and Northern Ireland. It includes all productive operations in the United Kingdom. For the 1935 census, the Business Statistics Office followed the same procedure as for the census of 1930. Proprietors employing an average of under ten people a year were not required to report detailed returns. Small firms were only asked to give information on the average number of their male and female employees and the nature of the business. Rostas estimated employment not covered by the general reports of the census at 536,600 people, which is about 9.4 percent of total manufacturing employment (small and large firms) in that year.[22] The total labor force in the UK census made up 5,157,587 people. This number is derived from the average number of people/operatives employed during the year (based on monthly figures) and the administrative, clerical and technical staff (office and management staff) employed in one week in October. Although estimations were made of the number of outworkers, these were not included in the general reports.

The German census data comprise the German Empire (*Deutsches Reich)* within the borders of 1937, thus including Saarland but not Austria and Sudetenland. It basically covered all production units with five employees or more, but in some branches the level of gross output determined what firms were exempt. In several cases, however, all firms were taken into account, for example in mining, fuel, iron and steel, and chemicals.[23] Sometimes the cut-off point was set at ten employees, for example for bakeries and printing offices.[24] Repair shops and sometimes the handicraft sector, for example food processing, were left out. It is difficult to assess the share of employment not covered by the census. According to the workplace census of 1939, about twenty percent of German employees worked in firms with less than 11 people.[25] This may indicate that the left tail of the employment distribution was longer in Germany than in Britain. The German workplace census covered a wider field of total industrial employment, however, including repair work, handicrafts, and even services such as laundries and cleaning. For this reason, it is not easy to reconcile employment data covered by the German industrial census with the actual industrial employment in 1936. From the records in the archive we calculated a total number of 5,969,881 people employed in manufacturing. This is significantly different from what the published version of the census implies. If we apply the same

[20] Board of Trade, *Final Report*. We did not use the ISIC, to keep as close as possible to the original classification. The British census was the model for the German statisticians. This British viewpoint imputes a British structure to German industry, however, a bias that is unavoidable.
[21] See Appendix 1 and 2.
[22] Rostas, *Comparative Productivity,* p. 25.
[23] In these industries, material inputs were considered to be important for warfare.
[24] Reichsamt, *Die deutsche Industrie*, pp.12, 44-55.
[25] Länderrat, *Statistisches Handbuch,* pp. 238-43.

definitions and thus exclude non-manufacturing employment in construction, mining, quarries and stone-cutting and utilities, the published record implies 5,874,791 people employed in industry.[26] The difference between the two figures is partly explained by certain industries being hidden under the category of 'construction and others' in the published census figures. Among them were aircraft production, and some branches of the chemical industry, in total 150,000 workers. Our calculation with the archival records also canceled out seasonal employment peaks in specific industries. In sugar production and in preserved foods, employment had been overestimated in the published census figures because the number of seasonal workers was reported instead of a representative average for the whole year, as had been done in the UK. This leads to a downward adjustment of about 55,000 workers. For all German industries, we took the average of June and December as given in the archival records. In cases where the business year did not match the calendar year, two other appropriate months had been recorded.

Estimating potential bias between both censuses

Because small companies were treated differently in each country's census, comparative productivity levels for Germany might be biased downwards. The reason is that the German census includes most of the group of firms employing five to ten employees, whereas the British does not. The effect could be large if the level of productivity of small firms was substantially lower than for total manufacturing. Fortunately, the UK census gives information on productivity levels by firm size. We calculated that the smallest firms in the British census (between 11-24 workers) averaged about ninety percent of the productivity of manufacturing as a whole. We know that the share of the total manufacturing labor force in the firm-group between one to ten workers was about ten percent in the UK.[27] Now let us assume that the 5-10 group (which is included in the German census but not in the British) had a productivity level of eighty percent of the total industry-average in the UK. Including this hypothetical group in the UK census, would result in a downward adjustment of the productivity level for total British manufacturing of maybe two percent, but certainly not more. Or stated from the German point of view, the downward bias of average productivity for German manufacturing as a whole vis-à-vis the UK was two percent at maximum.

Generally, the concepts of gross output, intermediate input and value added (or net output) used in both censuses are the same. Net output represents the value added through the manufacturing process, which is the sum of wages, salaries, rent, rates and taxes, depreciation of plant and machinery, advertisement and selling expenses and profits. This is equal to (gross) census value added at market prices. The only difference is the treatment of repair and maintenance of own capital goods. In the British census, firms had to include the materials used for the repair and maintenance of their own buildings and machinery in the intermediate inputs, whereas in the German statistics they were excluded. From the estimations in the official publication the value of repair and maintenance for total manufacturing can be calculated at RM 1,000-1,500 million, which is about 4 percent of total value added.[28] Because these repair and maintenance costs are included in German value added, productivity for German manufacturing as a whole is raised by four percent.

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[26] Rostas maintained that about 500,000 to 600,000 people deliberately were left out in the reported figures of the census (Rostas, "Industrial Production," p. 42.). We did not, however, find such a gap.
[27] Rostas, *Comparative Productivity*, p. 25.
[28] Reichsamt, *Die deutsche Industrie*, pp. 18, 37.

The census years for the comparison between the UK and Germany differ by one year. Apart from business cycle and capacity utilization effects, we also have to take account of the long term rise in productivity levels in both economies. To adjust for this we made use of the existing productivity time series estimates and calculated the average movement in productivity levels in both countries between 1935 and 1936.[29] We arrived at a three percent bias in favor of Germany, due to the fact that we measured German productivity of 1936 instead of 1935.

Finally, an adjustment could be made for differences in hours worked. Ideally, one would measure labor productivity as value added per hour worked, but detailed industry-level estimates of hours worked are not available. According to various sources the average working week in the UK was 47 hours per week compared to 45 in Germany.[30] This means that we in fact overstate British labor productivity by four percent in our comparison, if we express labor productivity in hours worked.

Table 1. Potential bias in measured productivity levels of the UK (1935) and Germany (1936)

	UK	Germany	Percentage bias in favor of Germany
Exemption limits	Less than 10	Less than 5	minus 2
Hours worked	47 hours	45 hours	minus 4
Repair in value added	Excluded	Included	plus 4
Year of comparison	1935	1936	plus 3
Net effect			plus 1

Sources: Authors'estimations from Board of Trade, *Final Report*; Reichsamt, *Die deutsche Industrie*; BA R3102.

We can conclude from the last row of Table 1 that the net effect of these biases on productivity for manufacturing as a whole was only on the order of one percent. Since we aim for maximum transparency we did not make any adjustments in our calculations on the aggregate or industry level.

[29] See Broadberry, *Productivity Race*, p. 44.
[30] Rostas, "Industrial Production", 46.

Adjustments for duties and taxes

In general, excise duties and consumer taxes are not included in the value added. For some industries in the census reports, however, duties are included in the gross production value. To put both countries on the same footing, we deducted excises from the gross production value in Table 2.

Table 2. Gross production value adjusted for duties and taxes. UK and Germany 1935-1936

	UK 1935 in £1,000	Germany 1936 in RM1,000
Total gross production value in the census	2,837,124	56,868,856
Duties/excises		
Silk	2,091	
Drugs	740	
Matches	2,110	
Margarine		232,321
Edible oils		119,526
Sugar	2,500	
Beer	55,300	
Aerated waters	700	
Tobacco	79,327	
Printing	70	
Adjusted gross production value	2,694,286	56,517,009

Sources: Authors'calculations from Board of Trade, *Final Report;* Reichsamt, *Die deutsche Industrie*; BA R3102.

In the UK we subtracted excises on silk, drugs, matches, printing, aerated waters, tobacco, sugar, and beer, according to the values mentioned in the General Report of the census. A special case here is the duty on tobacco, which was not paid for by firms on sales or gross output (as was the case in Germany) but on imports into the UK. We estimated this duty including subtracted drawbacks on tobacco exports from the UK at £79,327,000 and adjusted both intermediate inputs and gross output by this number. A similar duty was charged in the petroleum industry but we could not calculate the total amount because firms had been requested to include this in their statement of the cost of materials. In total, we deducted £142,780,000 from the UK gross production value. Therefore the gross production value in our study is £2,694.3 million instead of £2,837.1 million in the census. In the case of Britain, this adjustment had no effect on the net production value whatsoever. In the case of Germany, however, the gross production value as well as the value added derived from the archival sources included taxes for certain industries, namely for margarine and edible oils. The figures were adjusted by RM351.8 million.

3. New results from double deflation

Our method of comparing productivity levels is novel in two ways. First, we use producer prices to deflate value added, instead of using the more common quantity approach. Second, we apply double deflation, meaning that we deflate gross output and intermediate inputs separately, rather than doing a single deflation. To understand our approach a brief survey of existing research is necessary. Basically, two main approaches have been used in comparisons of sectoral productivity across nations: the quantity approach and the price approach. Most benchmark estimates before WWII are based on the comparison of physical quantities of output or related methods. These studies focus on output per worker, and follow the methodology of Rostas. In order to aggregate industries or branches of the economy, employment shares or value-added shares are applied.[31] Data availability for the postwar period has allowed a more sophisticated methodology, based on the calculation of real output using relative prices, or purchasing power parities (PPPs).[32] The price approach is considered superior to the quantity approach because the representation of matched output for non-matched output is higher for price than for quantity ratios.[33] This procedure was popularized by the seminal study of Deborah Paige and Gottfried Bombach in their Anglo-American comparison for 1950.[34] It has been applied frequently afterwards in studies for the post-war period, but also in some pre-war studies of manufacturing.[35] As value added is deflated by a single PPP for output, it is called single deflation.

The crucial element in these studies is the estimation of PPPs for output. These are proxied in two ways: by using final expenditure prices and by using unit values based on values and quantities of produced output.[36] Examples of the former include Patrick O`Brien and Caglar Keyder, who calculated purchasing power parities between Britain and France for seven benchmark years between 1785 and 1907, using expenditure prices. Fremdling's Anglo-German comparison for the period 1855 - 1913 uses six benchmarks based not only on expenditure prices but on unit values as well. Jean-Pierre Dormois compared UK and French industrial value added per worker in 1930, using expenditure prices of standard industrial commodities.[37] Applying expenditure prices to compare value added by industry, however, raises a major problem. Expenditure prices (for example of shoes) do not only reflect costs made in the industry in question (shoemaking), but also comprise other costs made in the production chain such as transport and trade activities. Therefore expenditure PPPs require adjustments for taxes and subsidies, and for trade and transport margins. In addition, proxies based on expenditure PPPs also need adjusting to exclude the relative prices of imported goods and include the relative prices of exported goods, as they should reflect domestic output prices. And most important, the

[31] Rostas, *Comparative Productivity*; Rostas," Industrial Production."
[32] The use of the term of "purchasing power parity" in the literature is ambiguous. In the international trade literature, "purchasing power parity" or "PPP" expresses the notion that exchange rates in the world should be such that it is possible to purchase the same bundle of goods and services anywhere in the world with, say, one dollar or one pound. In the work of the International Comparisons Program, the term of "PPP" was diluted and used as a shorthand for the ratio of expenditure prices across countries (Kravis, "Survey"). Ever since, "PPP" has been used as a shorthand for relative prices across countries. We keep in line with this tradition by using the term of "PPP" for any comparison of prices across space, either expenditure, producer output, or input prices.
[33] Kravis, "Survey," p. 4.
[34] Paige and Bombach, *Comparison.*
[35] See van Ark, *International Comparisons,* for an overview of comparisons for the post-war period.
[36] For comparisons of agricultural output it is sometimes feasible to derive PPPs on the basis of genuine producer output prices, but not for manufacturing, which has a much larger set of goods.

set of products for which expenditure prices are available does not cover intermediate products such as many agricultural, mining, and basic manufacturing goods, which are only used as intermediate inputs, and not for final consumption (for example pig iron, paper pulp, or basic chemicals). Hence the use of expenditure prices is not straightforward. Instead, output prices are to be preferred conceptually. They have been used extensively in the ICOP (International Comparisons of Output and Productivity) project at the University of Groningen, but mostly for the post-1970 period.[38] Our study is in this tradition.

Applying the double deflation method

So far, all previous historical studies in the price tradition have relied on a single-deflation procedure, deflating value added by a single PPP for gross output. The single deflation method, however, is "not so tidy and conceptually less satisfying."[39] It is well known that the theoretically correct procedure would be to obtain data on gross output and intermediate inputs in both countries and to convert them to a common currency using separate PPPs for output and intermediate inputs. Single deflated measures may differ substantially from double deflated measures when there are major differences in the technical input-output coefficients of an industry between two countries. This might be due to, for example, differences in production methods, the type of materials used, and the amount of imported material. Similarly, when relative prices of output and input differ across countries, single deflated productivity measures might be misleading.

There are two main reasons why double deflation has not been applied in practice so far: lack of price data on intermediate inputs and possible volatility of the deflated value added measure. Because value added is the residual between real output and real intermediate input, which have been separately deflated, measurement errors in either set of prices tend to be magnified.[40] In this study, however, we have a set of unit values for both gross output and intermediate inputs for Germany and the UK at our disposal. The unit values are taken as proxies for output and intermediate input prices. And the results show that double deflation is feasible, generating reliable results in line with expectations.

As a first step, unit values (uv) are derived by dividing ex-factory output values (o) by produced quantities (q) for each product i in each country

$$uv_i = \frac{o_i}{q_i} \qquad (1)$$

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[37] O`Brien and Keyder, Economic *Growth,* p. 44; Fremdling, "Productivity Comparison", p. 32; Dormois, "Episodes," p. 345; see also Broadberry, *Productivity Race.*

[38] See van Ark and Timmer, "Notes and Communications" for an elaborate discussion. For ICOP studies for the postwar period, see www.ggdc.net. See de Jong, *Catching Up Twice,* p. 37, for a pre-war comparison of Dutch labor productivity levels with levels in the UK and Germany using output unit values derived from census data.

[39] See Paige and Bombach, *Comparison*, p. 82.

[40] See Geary, "Concept," p. 258; Paige and Bombach, *Comparison*, p. 81.

The unit value can be considered as an average price, averaged throughout the year for all producers and across a group of similar products, *sold in domestic as well as foreign markets, thus including exports*. Subsequently, in a bilateral comparison, broadly defined products with similar characteristics are matched, for example boilers, cigarettes, margarine and car tires. For each matched product, the ratio of the unit values in both countries is taken. This unit value ratio (UVR) is given by

$$UVR_i^{BA} = \frac{uv_i^B}{uv_i^A} \qquad (2)$$

A and B are the countries being compared, with A taken as the base country. The product UVR indicates the relative producer price of the matched product in the two countries. Product UVRs need to be aggregated to derive converters for gross output for individual industries or for the aggregate sector (Henceforth we shall label these converters GO-PPP with a superscript for the country and subscript if a particular industry is concerned). This can be done in a single step from product to aggregate manufacturing, but also in multiple steps. Because only a selected number of products are matched, the UVRs are then weighted several times, first according to their output share in the individual industry, then according to the industry's share in the branch of manufacturing and finally according to the branch share in manufacturing as a whole. As a result, the aggregate GO-PPP better reflects the actual share of each underlying product item for which UVRs are available in total output. The GO-PPP for industry j based on the industry-of-origin approach is given by

$$GO\text{–}PPP_j^{BA} = \sum_{i=1}^{I_{j,GO}} w_{ij}\, \mathrm{UVR}_{ij}^{BA} \qquad (3)$$

with $i = 1,.., I_{j,GO}$ the matched output products in industry j; $w_{ij} = o_{ij} / o_j$ the output share of the i^{th} commodity in industry j; and $o_j = \sum_{i=1}^{I_{j,GO}} o_{ij}$ the total matched value of output in industry j. In bilateral comparisons the weights of either the base country (A) or the other country (B) can be used, which provide a Laspeyres and a Paasche type PPP respectively. The Laspeyres gross output PPP, $GO\text{–}PPP_j^{BA(A)}$, is given by

$$GO\text{–}PPP_j^{BA(A)} = \sum_{i=1}^{I_{j,GO}} w_{ij}^{A(A)}\, \mathrm{UVR}_{ij}^{BA} \qquad (4)$$

And the Paasche by

$$GO\text{–}PPP_j^{BA(B)} = \sum_{i=1}^{I_{j,GO}} w_{ij}^{A(B)} \, \mathrm{UVR}_{ij}^{BA} \qquad (5)$$

with $w_{ij}^{A(A)}$ the output weights of product *i* in base country prices and quantities, and $w_{ij}^{A(B)}$ the quantity weights of the other country valued at base country prices. The geometric average of the Laspeyres and Paasche indices, the Fisher index, is often used when a single currency conversion factor is required. PPPs for intermediate input can be derived in a similar way. The Laspeyres intermediate input PPP, $II\text{–}PPP_j^{BA(A)}$, is given by

$$II\text{–}PPP_j^{BA(A)} = \sum_{i=1}^{I_{j,II}} v_{ij}^{A(A)} \, \mathrm{UVR}_{ij}^{BA} \qquad (6)$$

And the Paasche by

$$II\text{–}PPP_j^{BA(B)} = \sum_{i=1}^{I_{j,II}} v_{ij}^{A(B)} \, \mathrm{UVR}_{ij}^{BA} \qquad (7)$$

with $i = 1,..,\ I_{j,II}$ the matched intermediate inputs in industry *j* with $v_{ij}^{A(A)}$ the intermediate input weights of product *i* in base country prices and quantities, and $v_{ij}^{A(B)}$ the quantity weights of the other country valued at base country prices. Both the output and the input weights are calculated directly from the census data.

From both output and intermediate input PPPs we can now calculate the double deflated PPPs. Let GO_j^A and II_j^A denote respectively the value of gross output and intermediate input of industry j in country A at national prices, and similarly for B. The Laspeyres value added PPP, $VA\text{–}PPP_j^{BA(A)}$, is then given by

$$VA\text{–}PPP_j^{BA(A)} = \frac{GO_j^A \times GO\text{–}PPP_j^{BA(A)} \quad - \quad II_j^A \times II\text{–}PPP_j^{BA(A)}}{GO_j^A - \quad II_j^A} \qquad (8)$$

And the Paasche value added PPP, $VA\text{–}PPP_j^{BA(B)}$, is given by

$$VA\text{–}PPP_j^{BA(B)} = \frac{GO_j^B - II_j^B}{GO_j^B / GO\text{–}PPP_j^{BA(B)} - II_j^B / II\text{–}PPP_j^{BA(B)}} \qquad (9)$$

It can easily be seen that in the case of identical gross output and intermediate input PPPs, the value added PPP is the same as the gross output PPP. But if not, the difference between the two depends on the share of intermediate inputs in gross output *and* the difference between the GO- and II-PPPs.

PPP results

We started from estimating the unit value ratios by matching products between the UK and Germany. Both in the UK census and the archival records of the German census, there is a wealth of information on the product level to calculate average prices. For output, it was possible to match 229 products ranging from cotton yarn to various chemical products, for all branches of industry.[41] The numbers of matches as well as coverage ratios (the share of total gross production value covered by products for which a match could be made) differ across branches, which is explained by the availability and heterogeneity of products, by differences in quantity specifications (units of measurement), the unique national character of some products and by differences in quality across countries. For total output, coverage ratios are 42 percent, for both countries.

We also matched intermediate inputs. The assumption that the unit value ratio for the matched products is representative of all the unmatched products is harder to make than in the case of outputs, because of the heterogeneity of intermediate inputs. There are, however, many examples of inputs that are recorded for several classes of semi-manufactured products that cover a large fraction of intermediate inputs. In total, 129 matches could be made with a coverage ratio of 35-37 percent for total manufacturing. We were not able to match quantities and values of fuel and electricity because the German census only records the value of the fuel consumption but no related quantities. In many industries, however, the fuel bill is a small fraction of total intermediate input, in most cases less than five percent.[42]

Appendix 5 provides the gross output, value added and intermediate input PPPs resulting from the calculations according to the methodology described above. We present the Laspeyres, Paasche, and Fisher PPPs that result from our binary comparisons. The ratios differ across industries. Output PPPs are high in the textile, leather, clothing and food industries. In these industries producer output prices were higher in Germany than in the UK. In 8 out of the 12 branches the Laspeyres PPP is higher than the Paasche PPP, implying that relative German prices are higher with British weights than with German weights. This is the standard Gerschenkron effect. In a two-country comparison, the Gerschenkron effect implies that the use of quantity weights of one country will lead to an overstatement

[41] A detailed list of all products and related values/weights is supplied in Appendix 3 and Appendix 4.
[42] Paige and Bombach, *Comparison*, p. 193.

of the other country's prices, the more the price structures of the two countries differ.[43] This effect occurs because goods with a high (low) price in one country relative to the other country are associated with relatively small (large) quantities. Interestingly, we do not find a Gerschenkron effect in iron and steel, non-ferrous metals, or food processing. The non-existence of a Gerschenkron effect for these industries implies that consumer preferences are not fully reflected in price setting. Similar findings were reported for (former) centrally planned economies in the 1980s.[44] This clearly suggests distortions in the price formation and production allocation process in Germany in 1936.[45] Using our deflation procedure thus adjusts for administrative price setting and reveals the real effects of the distortion of the German price vector.

Using both output and intermediate input PPPs in equations (8) and (9) we now can calculate the double deflated value added PPPs. The results for the value added PPPs are also given in Appendix 5. Again the difference between Laspeyres and Paasche is small. Using the structure of the branches of manufacturing in Germany or the UK does not make much difference. The overall Fisher value added PPP is RM17.9/£. We can compare this figure with alternative estimates. It is, for example, very close to a PPP of RM17.1/£ calculated by the *Institut für Konjunkturforschung* for the year 1935.[46] And it is well above the (overvalued) official exchange rate of RM12.3/£.[47]

The last column of Appendix 5 gives, the ratio of the (Fisher) value added PPP to the (Fisher) gross output PPP. This ratio reflects the productivity of capital and labor in the production process. A higher PPP for output than for intermediate input (as with textiles) may indicate that the German textile industry faces higher costs (labor costs, capital costs or profit margins) than the UK industry. The cross-industry differences in value added PPP are larger than for gross output. This is to be expected from the double deflation method, where small differences between input and output PPPs tend to be magnified, due to the low share of value added in gross output.

[43] Gerschenkron, "A Dollar Index."
[44] See van Ark, Monnikhof and Timmer, "Prices."
[45] The studies by Geer (*Markt*, pp. 40-41) and Höschle (*deutsche Textilindustrie*, pp. 60-66) present direct evidence of price regulations by the government.
[46] This PPP was taken from the *Institut für Konjunkturforschung* (Institute for Business Cycle Research later named *Deutsches Institut für Wirtschaftsforschung* DIW). In their *Wochenbericht* (12, 1939 No. 25) industrial production of the USA and UK were compared with Germany. It is not clear in which way the converter was calculated precisely. In any case they took an exchange rate of the past, probably the gold exchange rate of 1929 and adjusted it for price movements until 1935, the year of comparison.
[47] Exchange rate from Svennilson, *Growth*, p. 318.

4. Comparative value added and labor productivity by branch

In Appendix 6 we compare value added and employment by manufacturing branch, using the Fisher value added PPPs to put value added in comparative prices. Total value added of the German census data was 24 percent higher than the UK, and employment about 16 percent. In both countries the branches of iron and steel, engineering, and non-ferrous metals combined comprised the largest sector. The share in Germany made up 42 percent of value added and 41 percent of employment. In the UK the shares were 33 and 34 percent, respectively. Textiles, leather and clothing came in second place amounting to 16 percent of value added and 23 percent of employment in Germany versus 21 percent and 32 percent in the UK. Note that in both countries labor productivity levels were rather low in textiles and just average in the metal industry. On the other hand, both food and chemicals showed high productivity, a sign of great capital intensity. These industries amounted to 23 percent of value added in Germany and employed 14 percent of the labor force, compared to 24.5 and 14 percent, respectively, in the UK. Output characteristics thus suggest that Germany produced relatively more capital-intensive and intermediate goods (metals, chemicals), while in Britain industries produced consumption goods (textiles, clothing, food, paper and printing).

Table 3 presents our major results: it compares labor productivity (real value added per worker) in the UK and Germany for manufacturing as a whole and for different branches of industry. It is derived using newly calculated relative prices and both for *single* and *double* deflation. According to the table Germany had a labor productivity advantage of five percent with *single* deflation and seven percent with *double*. Thus on the aggregate level of manufacturing as a whole, both countries had similar labor productivity.

Table 3. Labor productivity per branch in manufacturing. UK and Germany 1935-1936

	Value added per worker (Germany as percentage of UK)	
	Single deflated	Double deflated
Textile Trades	96.7	76.2
Leather Trades	72.7	47.1
Clothing Trades	93.5	93.4
Iron and Steel Trades	133.5	175.1
Engineering, Shipbuilding & Vehicles Trades	112.3	106.1
Non-Ferrous Metals Trades	133.4	103.9
Food, Drink and Tobacco Trades	68.3	77.8
Chemical and Allied Trades	111.2	125.5
Miscellaneous Trades	99.8	94.6
Clay and Building Materials Trades	97.7	105.7
Paper, Printing and Stationery Trades	102.9	141.0
Timber Trades	151.0	90.1
Total manufacturing	105.4	106.8

Sources: Appendix 5 and Appendix 6

Across specific branches of industry, however, there were widespread differences in labor productivity between the two countries. And the magnitude of these differences was sensitive to whether *single* or *double* deflation was used. The choice of *single* or *double* deflation did not greatly change the rank order of comparative productivity levels among industrial branches. But Anglo-German differences did become more pronounced in most cases (7 out of 12), with double deflation, and in two instances the comparative performance is even reversed. In particular, German performance in textiles and leather fell much further below British achievements with double deflation. With food manufacturing, however, double deflation raised German labor productivity by taking into account the relatively high German prices of intermediate inputs, such as wheat, brought on by tariffs and the German government's agricultural policy.[48] Our double-deflated estimate of German comparative performance in food processing was thus much higher than those obtained from quantity comparisons or single deflation. Double deflation also made the German advantage in chemicals and paper much clearer, since it corrected for relatively high intermediate input prices in Germany. It did the same for the metal industry, giving Germany much higher labor productivity in iron and steel, but little advantage in other metallurgical sectors.[49]

Although the aggregate results do not depart significantly from previous estimates, the figures for particular industries are strikingly different. If our comparison is used as a new benchmark for time series projection, its effects will be ambiguous. They will depend on how our aggregate results are linked to aggregate indices of manufacturing or on how the estimate for the industrial branches presented here are tied to time series of productivity for each industry.

[48] Two recent articles analysed the severe consequences of high and rising food prices for the standard of living in Germany. Steiner, "Neueinschätzung"; and Baten and Wagner, "Mangelernährung"; see also Abelshauser, "Germany," pp. 143-47.

[49] An increasing intervention and regulation of the iron and steel branch was put forward by Geer, *Markt.* For price distortions in 1936 see pp. 39-45.

5. Conclusions

It seems that on the aggregate level the outcome of our productivity comparison is unaffected by choice of method. Using single deflation we find that Germany led the UK in labor productivity by five percent, and by seven percent using our preferred method of double deflation. Both estimates are close to the previous finding of Broadberry and Fremdling, who used a quantity approach and a smaller set of industries. On the disaggregated level of specific branches, double deflation makes a difference. We find a much lower German performance in textiles and engineering branches than Broadberry and Fremdling, but higher levels for non-ferrous metal, clay and building materials, iron and steel, and especially food. Our double deflated results seem more plausible because they adjust for big differences in prices of intermediate inputs. The price differences can be tracked back to Germany's striving for autarky, which led to distorted prices and production structures in the 1930s. Our archival evidence invalidates Hoffmann's reconstruction of German national accounts for 1850-1959, which relies on the misleading and incomplete information in the published version of the census. As a result Angus Maddison's data will be affected too because the Hoffmann time series underlie his country entries for Germany.[50] Specifically, these new benchmark estimates can be used for backward extrapolations to shed new light on the comparative performance of the UK and Germany before WWI and they may contribute to improvements on Hoffmann's time series for German industrial output.[51]

[50] Maddison, *World Economy.*

[51] Albrecht Ritschl recently corrected the Hoffmann-index on German industrial output for the period 1913-1938 by imputing a new series for metal processing. This adjustment yields figures indicating a less marked growth during the interwar period. If, however, Ritschl´s time series is extrapolated backwards from our benchmark 1935/36 it yields a very high productivity level for Germany vis-à-vis Britain for the period before WWI, which is far above the benchmark estimates reported by Broadberry/Burhop. A first step to solve this contradictory evidence is to produce a completely new time series on industrial output, as suggested by Ritschl. This means making further use of the unpublished 1936-census data and additional archival sources available at the Federal Archive Berlin-Lichterfelde. See the discussion in Ritschl, "Spurious growth"; Burhop and Wolff, "Compromise Estimate"; and Broadberry and Burhop, Comparative Productivity.

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Appendix 1. Census 1935 UNITED KINGDOM and Census 1936 GERMANY

Industry/branch	UK census 1935						German census 1936					
	Number of establishments*	Gross output (selling value of goods made and value of work done) excl. Duties	Costs of materials used and amount paid for work given out	Net output (excess of col. (3) over col. (4))	Average number of persons employed (excluding out-workers)	Net output per person employed	Number of establishments*	Gross output (selling value of goods made and value of work done) excl. Duties	Costs of materials used and amount paid for work given out	Net output (excess of col. (9) over col. (10))	Average number of persons employed (excluding out-workers)	Net output per person employed
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	No.	£ 000	£ 000	£ 000	No.	£	No.	RM 1000	RM 1000	RM 1000	No.	RM
Textile Trades		443,876	286,373	157,503	1,054,860			7,070,203	4,238,651	2,831,552	906,187	
Cotton Spinning and Doubling	818	74,324	54,126	20,198	182,415	111	429	808,971	500,623	308,348	109,116	2,826
Cotton Weaving	1,057	69,348	48,876	20,472	166,904	123	1,519	1,458,795	830,659	628,136	186,322	3,371
Woollen and Worsted	1,518	129,716	86,167	43,549	242,209	180	1,625	1,951,049	1,350,921	600,128	175,793	3,414
Silk and Artificial Silk	333	34,019	19,920	14,099	81,825	172	288	614,760	313,579	301,181	83,507	3,607
Linen and Hemp	310	24,026	16,963	7,063	69,152	102	494	303,295	168,669	134,626	51,232	2,628
Jute	85	8,079	5,173	2,906	24,190	120	92	158,197	99,183	59,014	22,346	2,641
Hosiery	939	39,486	22,224	17,262	115,273	150	2306	787,119	416,686	370,433	140,182	2,643
Textile Finishing	857	30,462	12,111	18,351	100,084	183	881	438,115	220,358	217,757	62,142	3,504
Lace	277	7,155	4,320	2,835	16,342	173	1520	331,261	226,188	105,073	52,230	2,012
Rope, Twine, and Net	156	5,536	3,360	2,176	15,276	142	29	7,368	3,742	3,626	1,490	2,434
Canvas, Goods, and Sack	191	5,447	3,998	1,449	8,844	164	300	86,496	60,838	25,658	7,002	3,664
Asbestos Goods and Engine and Boiler Packing	72	4,980	2,002	2,978	9,545	312	58	40,136	11,578	28,558	4,871	5,863
Flock and Rag	166	4,859	3,714	1,145	5,586	205	e.c.	e.c.	e.c.	e.c.	e.c.	e.c.
Elastic Webbing	44	1,982	1,025	957	6,565	146	e.c.	e.c.	e.c.	e.c.	e.c.	e.c.
Coir Fibre, Horse-hair & Feather	67	1,980	1,251	729	4,058	180	38	12,325	7,024	5,301	1,177	4,504
Roofing Felts	25	1,302	711	591	1,602	369	39	28,017	16,466	11,551	2,989	3,865
Packing	123	1,175	432	743	4,990	149	e.c.	e.c.	e.c.	e.c.	e.c.	e.c.
Cotton wool and dressing material	e.c.	e.c.	e.c.	e.c.	e.c.	e.c.	208	44299	12137	32,162	5,788	5,557
Leather Trades		34,360	23,692	10,668	50,533			933,671	531,060	402,611	92,946	
Fellmongery	62	2,652	2,124	528	2,431	217	e.c.	e.c.	e.c.	e.c.	e.c.	e.c.
Leather (Tanning and Dressing)	456	26,032	18,487	7,545	30,286	249	1102	608,541	342,150	266,391	44,747	5,953
Leather Goods	323	5,676	3,081	2,595	17,816	146	1710	325,130	188,910	136,220	48,199	2,826
Clothing Trades		179,116	98,121	80,995	535,886			2,299,619	1,223,890	1,075,729	350,110	
Tailoring, Dressmaking, Millinery, etc.	5,022	116,770	64,854	51,916	362,334	143	6,698	1,529,850	792,650	737,200	224,113	3,289
Boot and Shoe	1,116	42,017	21,936	20,081	122,734	164	1,450	647,338	369,659	277,679	103,911	2,672
Hat and Cap	383	10,719	5,757	4,962	30,088	165	e.c.	e.c.	e.c.	e.c.	e.c.	e.c.
Glove	157	3,036	1,649	1,387	10,256	135	301	52,930	31,609	21,321	12,992	1,641
Fur	212	5,484	3,234	2,250	7,647	294	470	69,501	29,972	39,529	9,094	4,347
Umbrella and Walking Stick	70	1,090	691	399	2,827	141	e.c.	e.c.	e.c.	e.c.	e.c.	e.c.

Industry/branch	UK census 1935						German census 1936					
	Number of establishments*	Gross output (selling value of goods made and value of work done) excl. Duties	Costs of materials used and amount paid for work given out	Net output (excess of col. (3) over col. (4))	Average number of persons employed (excluding out-workers)	Net output per person employed	Number of establishments*	Gross output (selling value of goods made and value of work done) excl. Duties	Costs of materials used and amount paid for work given out	Net output (excess of col. (9) over col. (10))	Average number of persons employed (excluding out-workers)	Net output per person employed
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	No.	£ 000	£ 000	£ 000	No.	£	No.	RM 1000	RM 1000	RM 1000	No.	RM
Iron and Steel Trades		280,585	164,077	116,508	539,270			9,888,140	5,773,683	4,114,457	950,573	
Iron and Steel (Blast Furnaces)	48	21,047	16,964	4,083	15,815	258	42	847,973	635,316	212,657	27,495	7,734
Iron and Steel (Smelting and Rolling)	318	101,792	68,129	33,663	135,274	249	190	4,143,912	3,116,527	1,027,385	178,172	5,766
Iron and Steel Foundries	847	39,018	16,160	22,858	109,643	208	2931	1,282,798	472,316	810,482	205,319	3,947
Tinplate	66	13,925	9,011	4,914	21,985	224	868	424,186	210,022	214,164	62,545	3,424
Hardware, Hollow-ware, Metallic Furniture etc.	1,165	35,931	17,925	18,006	97,778	184	e.c.	e.c.	e.c.	e.c.	e.c.	e.c.
Chain, Nail, Screw and Miscellaneous Forgings	570	21,357	10,722	10,635	56,783	187	2671	1,194,742	533,468	661,274	153,422	4,310
Wrought Iron and Steel Tube	94	16,589	9,666	6,923	28,387	244	e.c.	e.c.	e.c.	e.c.	e.c.	e.c.
Wire	220	15,723	9,953	5,770	23,427	246	1259	501,623	258,360	243,263	67,444	3,607
Tool and Implement	321	7,955	3,028	4,927	25,508	193	1539	175,391	52,561	122,830	34,502	3,560
Cutlery	148	3,623	1,245	2,378	10,809	220	925	103,520	30,276	73,244	16,456	4,451
Needle, Pin and Metal Smallwares	105	3,203	1,139	2,064	12,462	166	3055	1,137,209	446,369	690,840	184,639	3,742
Small Arms	31	422	135	287	1,399	205	93	76,786	18,468	58,318	20,579	2,834
Engineering, Shipbuilding and Vehicles Trades		491,418	242,096	249,322	1,104,363			10,505,243	4,327,351	6,177,892	1,385,384	
Mechanical Engineering	3,133	171,788	73,761	98,027	432,811	226	5,044	4,444,936	1,672,256	2,772,680	621,055	4,464
Electrical Engineering	854	106,853	49,509	57,344	247,948	231	1284	2,315,193	851,111	1,464,082	309,816	4,726
Shipbuilding	392	35,814	19,890	15,924	82,020	194	326	503,561	230,043	273,518	78,105	3,502
Motor and Cycle	2,541	151,026	86,648	64,378	279,748	230	949	2,212,926	1,141,585	1,071,341	217,917	4,916
Aircraft	52	13,919	5,467	8,452	35,032	241	74	885,502	361,257	524,245	135,210	3,877
Railway, Carriage and Wagon Building	138	9,757	5,650	4,107	20,651	199	35	107,844	50,245	57,599	18,897	3,048
Carriage, Cart and Wagon	121	2,261	1,171	1,090	6,153	177	29	35,281	20,854	14,427	4,384	3,291
Non-Ferrous Metals Trades		107,922	77,975	29,947	122,097			2,024,714	1,374,298	650,416	129,280	
Copper and Brass (Smelting, Rolling etc.)	248	21,343	14,316	7,027	28,052	250	33	300,592	268,373	32,219	6,265	5,143
Aluminium, Lead, Tin etc. (Smelting, Rolling etc.)	232	33,249	23,476	9,773	27,238	359	229	544,053	369,800	174,253	25,684	6,784
Gold and Silver Refining	23	31,182	30,155	1,027	2,367	434	23	129,005	116,544	12,461	701	17,776
Finished Brass	387	11,542	4,787	6,755	34,824	194	192	804,516	505,836	298,680	43,907	6,803
Plate and Jewellery	458	9,194	4,577	4,617	25,587	180	1812	146,993	73,399	73,594	30,960	2,377
Watch and Clock	66	1,412	664	748	4,029	186	275	99,555	40,346	59,209	21,763	2,721

Industry/branch	UK census 1935						German census 1936					
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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	No.	£ 000	£ 000	£ 000	No.	£	No.	RM 1000	RM 1000	RM 1000	No.	RM
Food, Drink and Tobacco Trades		525,916	324,401	201,515	520,649			9,092,007	5,548,709	3,543,298	549,244	
Grain Milling	502	65,125	53,175	11,950	30,135	397	3360	1,695,116	1,339,486	355,630	35,164	10,113
Bread, Cakes, etc.	2,644	63,986	35,670	28,316	110,637	256	581	256,971	175,026	81,945	16,432	4,987
Biscuit	98	16,867	7,681	9,186	44,001	209	119	74,007	48,581	25,426	5,581	4,556
Cocoa and Sugar Confectionery	362	36,804	19,237	17,567	74,169	237	1097	667,233	375,315	291,918	63,823	4,574
Preserved Foods	431	36,762	20,993	15,769	49,970	316	2573	574,421	336,383	238,038	46,560	5,113
Bacon, Curing and Sausage	384	34,733	28,383	6,350	19,695	322	671	565,427	424,864	140,563	20,007	7,026
Butter, Cheese, Condensed Milk and Margarine	184	28,740	21,884	6,856	15,085	455	294	473,931	263,746	210,185	14,510	14,486
Sugar and Glucose	43	42,225	36,962	5,263	16,507	319	233	1,130,589	799,937	330,652	60,197	5,493
Fish Curing	237	4,324	3,312	1,012	5,543	182	467	134,285	87,320	46,965	16,867	2,784
Cattle. Dog and Poultry Foods	148	10,461	6,880	3,581	9,062	395	509	219,402	178,569	40,833	5,961	6,850
Ice	75	993	222	771	1,845	418	e.c.	e.c.	e.c.	e.c.	e.c.	e.c.
Brewing and Malting	592	67,100	23,090	44,010	55,809	789	1464	1,289,550	454,788	834,762	79,484	10,502
Spirit Distilling	58	4,662	2,346	2,316	3,220	719	5462	543,217	382,885	160,332	23,831	6,728
Spirit Rectifying, Compounding and Methylating	19	7,344	6,323	1,021	928	1,100	58	249,064	201,969	47,095	2,028	23,222
Aerated Waters, Cider, Vinegar and British Wine	448	9,809	3,881	5,928	17,861	332	482	64,405	28,170	36,235	4,492	8,067
Wholesale Bottling	494	53,348	40,109	13,239	23,323	568	e.c.	e.c.	e.c.	e.c.	e.c.	e.c.
Tobacco	118	42,633	14,253	28,380	42,859	662	624	1,154,389	451,670	702,719	154,307	4,554
Chemical and Allied Trades		191,708	103,222	88,486	194,011			5,374,912	2,955,121	2,419,791	285,151	
Chemicals, Dyestuffs and Drugs	601	68,021	31,473	36,548	77,611	471	1856	1,753,320	809,093	944,227	103,487	9,124
Fertiliser, Disinfectant, Glue, etc.	164	7,348	4,380	2,968	9,619	309	560	829,471	493,488	335,983	39,826	8,436
Soap, Candle and Perfumery	226	26,308	13,140	13,168	29,114	452	2266	714,348	306,300	408,048	42,443	9,614
Paint, Colour and Varnish	342	22,140	11,294	10,846	24,893	436	1154	429,164	206,709	222,455	29,967	7,423
Seed Crushing	49	22,625	18,203	4,422	11,542	383	844	644,753	529,171	115,582	12,641	9,143
Oil and Tallow	201	17,644	11,980	5,664	9,717	583	850	96,583	69,186	27,397	4,925	5,563
Petroleum	25	8,420	5,230	3,190	4,157	767	197	508,818	333,920	174,898	21,783	8,029
Explosives and Fireworks	45	5,566	2,255	3,311	9,870	335	117	259,731	145,280	114,451	20,814	5,499
Starch and Polishes	84	7,126	2,821	4,305	8,722	493	103	109,604	55,809	53,795	5,828	9,230
Match	30	2,235	718	1,517	3,767	403	31	29,120	6,165	22,955	3,437	6,679
Ink, Gum, and Typewriter Requisites	86	4,275	1,728	2,547	4,999	510	e.c.	e.c.	e.c.	e.c.	e.c.	e.c.

Industry/branch	UK census 1935						German census 1936					
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	No.	£ 000	£ 000	£ 000	No.	£	No.	RM 1000	RM 1000	RM 1000	No.	RM
Miscellaneous Trades		91,616	47,913	43,703	182,619			2,746,876	1,492,677	1,254,199	270,713	
Rubber	187	28,069	13,736	14,333	55,593	258	283	477,209	200,834	276,375	53,220	5,193
Scientific Instruments, Appliances and Apparatus	369	11,522	4,767	6,755	30,059	225	1430	433,978	122,959	311,019	78,638	3,955
Plastic Materials, Buttons and Fancy Articles	339	7,457	3,465	3,992	23,003	174	823	196,166	94,388	101,778	29,380	3,464
Coke and By-Products	113	16,495	12,340	4,155	14,061	296	110	709,696	556,034	153,662	23,541	6,527
Manufactured Fuel	9	739	585	154	832	185	645	427,755	328,695	99,060	14,891	6,652
Linoleum and Oilcloth	38	9,145	4,611	4,534	12,455	364	58	106,052	48,458	57,594	7,835	7,351
Musical Instruments	155	4,312	1,756	2,556	11,230	228	437	72,529	29,267	43,262	15,921	2,717
Brush	159	3,548	1,700	1,848	10,971	168	433	69,729	33,799	35,930	14,146	2,540
Games and Toys	106	2,993	1,380	1,613	10,907	148	595	77,015	33,236	43,779	17,378	2,519
Sports Requisites	146	2,919	1,305	1,614	8,253	196	e.c.	e.c.	e.c.	e.c.	e.c.	e.c.
Manufactured Abrasives	30	2,572	1,154	1,418	3,132	453	123	56,108	20,275	35,833	5,836	6,140
Incandescent Mantles	10	406	148	258	1,271	203	5	3,869	958	2,911	829	3,511
Cinematograph Film Printing	15	1,439	966	473	852	555	36	116,770	23,774	92,996	9,098	10,222
Clay and Building Materials Trades		84,935	30,849	54,086	249,438			1,703,915	525,655	1,178,260	355,374	
Brick and Fireclay	1,421	27,936	8,014	19,922	92,074	216	4,571	548,918	136,484	412,434	134,491	3,067
China and Earthenware	399	14,209	4,837	9,372	68,537	137	910	312,084	72,104	239,980	88,642	2,707
Glass	327	17,209	6,649	10,560	46,201	229	1103	344,749	111,224	233,525	74,368	3,140
Cement	65	9,706	3,938	5,768	10,220	564	113	267,552	114,635	152,917	20,030	7,634
Building Materials	776	15,875	7,411	8,464	32,406	261	2749	230,612	91,208	139,404	37,843	3,684
Timber Trades		78,670	41,402	37,268	194,894			1,940,764	988,313	952,451	323,009	
Timber (Sawmilling, etc.)	1,512	32,180	18,392	13,788	68,074	203	6,031	823,908	480,633	343,275	101,389	3,386
Furniture and Upholstery	1,800	39,477	19,232	20,245	109,226	185	4,934	972,941	427,565	545,376	191,969	2,841
Coopering	91	1,622	1,012	610	2,775	220	241	29,474	17,799	11,675	6,334	1,843
Cane and Wicker Furniture and Basketware	63	977	425	552	3,268	169	624	44,958	20,247	24,711	11,438	2,160
Wooden Crates, Cases, Boxes and Trunks	224	4,414	2,341	2,073	11,551	179	728	69,483	42,069	27,414	11,879	2,308

Industry/branch	UK census 1935						German census 1936					
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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	No.	£ 000	£ 000	£ 000	No.	£	No.	RM 1000	RM 1000	RM 1000	No.	RM
Paper, Printing and Stationery Trades		184,164	72,503	111,661	408,967			2,936,945	1,427,122	1,509,823	371,910	
Paper	267	40,624	23,790	16,834	59,748	282	1090	1,156,386	693,107	463,279	100,201	4,623
Wallpaper	37	3,264	1,277	1,987	6,096	326	38	26,590	11,199	15,391	2,921	5,269
Printing, Bookbinding, Stereotyping, Engraving, etc.	2,548	57,336	19,348	37,988	169,416	224	3,696	1,140,355	388,417	751,938	201,380	3,734
Manufactured Stationery	487	15,730	7,184	8,546	44,722	191	828	374,412	217,476	156,936	44,409	3,534
Printing and Publication of Newspapers etc.	510	50,772	12,964	37,808	79,454	476	e.c.	e.c.	e.c.	e.c.	e.c.	e.c.
Cardboard Box	581	13,920	6,902	7,018	41,899	168	971	205,741	103,758	101,983	16,976	6,007
Pens, Pencils and Artists' Materials	53	2,518	1,038	1,480	7,632	194	90	33,461	13,165	20,296	6,023	3,370
Total Manufacturing		2,694,286	1,512,624	1,181,662	5,157,587	229		56,517,009	30,406,530	26,110,479	5,969,881	4,374

Note: e.c. denotes elsewhere classified

Sources: UK from Board of Trade, *Final Report on the Fifth Census of Production and the Import Duties Act Inquiry* (1935), Parts I-IV;

Germany from Bundesarchiv Berlin-Lichterfelde, BA R3102. See Appendix 2 for matching of German industries to UK industries

Appendix 2. Matching of Classifications in Manufacturing. UK census 1935 and German census 1936

Branch/Industry		**Source** Bundesarchiv Berlin-Lichterfelde **BA R3102**
UK	**Germany**	
		Recordnumber
Textile Trades	**Textilindustrie**	
Cotton Spinning and Doubling	Baumwollspinnerei und –zwirnerei	3281
Cotton Weaving	Weberei	3281
Woollen and Worsted	Wolle und Kammgarn	3281
Silk and Artificial Silk	Kunstseiden und Seidenindustrie	3281
Linen and Hemp	Flachs-, Hanfspinnerei und –weberei	3281
Jute	Jutespinnerei und –weberei	3281
Hosiery	Strumpfwaren, Trikotagen	3281
Textile Finishing	Textilausrüstungs- und Veredelungsindustrie	3281
Lace	Nähfäden, Bandartikel, Posamenten, Spitzen etc.	3281
Rope, Twine, and Net	Netzindustrie	3281
Canvas, Goods, and Sack	Herstellung von Zelten, Planen, Säcken	3281
Asbestos Goods and Engine and Boiler Packing	Asbestindustrie	3543
Flock and Rag	No equivalent, see cotton, wool and dressing material	
Elastic Webbing	No equivalent, see cotton, wool and dressing material	
Coir Fibre, Horse-hair & Feather	Roßhaarspinnerei- und Weberei	3281
Roofing Felts	Filzherstellung	3281
Packing	No equivalent	
Cotton wool and dressing material	Watte und Verbandmittel	3281
Leather Trades	**Lederindustrie**	
Fellmongery	No equivalent	
Leather (Tanning and Dressing)	Lederfabriken und Gerbereien	3542
Leather Goods	Lederwaren	5915,5916
Clothing Trades	**Bekleidungsindustrie**	
Tailoring, Dressmaking, Millinery, etc.	Bekleidungsindustrie	3281
Boot and Shoe	Schuhindusrie	5915
Hat and Cap	No equivalent, see tailoring	
Glove	Handschuhindustrie	3281
Fur	Pelzveredlung und Verarbeitung	5916
Umbrella and Walking Stick	No equivalent, see miscellaneous	

Iron and Steel Trades	**Eisen- und Stahlindustrie, Eisen- und Stahlwaren**	
Iron and Steel (Blast Furnaces)	Hochofenwerke	3288
Iron and Steel (Smelting, Refining and Rolling)	Stahl- und Walzwerke	3288,3544
Iron and Steel Foundries	Gießereiindustrie, Herd- und Ofen	4152,3544
Tinplate	Blechwarenindustrie	5922
Hardware, Hollow-ware, Metallic Furniture etc.	No equivalent, see foundries	
Chain, Nail, Screw and Miscellaneous Forgings	Sonstige Zweige der Eisen- u. Metallwarenindustrie	5922
Wrought Iron and Steel Tube	No equivalent, see foundries	
Wire	Drahtwaren-Industrie	5922
Tool and Implement	Werkzeugindustrie	5922
Cutlery	Feine Schneidewarenindustrie	5922
Needle, Pin and Metal Smallwares	Schloß, Beschläge, Metallwaren, Bronze, Schriftgießereien	5922, 4152, 3274
Small Arms	Schußwaffenindustrie	5922

Maschinen-, Schiff- und Fahrzeugbau, Elektroindustrie		
Mechanical Engineering	Maschinen- und Stahlbau	3541, 3544
Electrical Engineering	Elektroindustrie	3546, 5922
Shipbuilding	Schiffbau	3540
Motor and Cycle	Kraftfahrzeug-, Fahrrad- und Fahrzeugteileindustrie	3540, 5922
Aircraft	Flugzeugindustrie	3540
Railway, Carriage and Wagon Building	Waggonbau	3540
Carriage, Cart and Wagon	Feld- undWerkbahnwagenbau	3540

Non-Ferrous Metals Trades	**Nichteisenmetallindustrie**	
Copper and Brass (Smelting, Rolling etc.)	Kupferhütten und -raffinerien**.**	4152
Aluminium, Lead, Tin etc. (Smelting, Rolling etc.)	Andere Nichteisenmetallhütten, -raffinerien	4152
Gold and Silver Refining	Gold- und Silberscheideanstalten	4152
Finished Brass	Walzen und Formen der Nichteisenmetalle	4152
Plate and Jewellery	Edelmetall-Schmuckwarenindustrie, technische Diamanten, Edelsteine	3275, 3279, 5922
Watch and Clock	Uhrenindustrie	3275,5922

Food, Drink and Tobacco Trades	**Nahrungs- und Genußmittelindustrie**	
Grain Milling	Getreidemüllerei, Schälmühlen	3282, 3638, 5922
Bread, Cakes, etc.	Brotindustrie und Bäckereien	3638, 5922
Biscuit	Teigwarenindustrie	3638, 5922
Cocoa and Sugar Confectionery	Süßwarenindustrie	3638, 5922
Preserved Foods	Konserven,Saft,Kartoffeltrocknerei,Nährmittel, Ersatzkaffee,Senf,Gewürze	3638,5922
Bacon, Curing and Sausage	Fleischwarenindustrie	3638,5922
Butter, Cheese, Condensed Milk and Margarine	Dauermilch,Schmelzkäse,Margarine- und Speisefettfabriken	5922,3638,3636
Sugar and Glucose	Zuckerindustrie	5922,3638

Fish Curing	Fischindustrie	3.639
Cattle. Dog and Poultry Foods	Futtermittelindustrie	3638,5922
Ice	No equivalent	
Brewing and Malting	Malz- und Brauindustrie	3638,5922
Spirit Distilling	Spiritusindustrie (ohne S.-reinigung u. S.-vergällung)	3638,5922
Spirit Rectifying, Compounding and Methylating	Spiritus-reinigung u. -vergällung	3270
Aerated Waters, Cider, Vinegar and British Wine	Traubenschaumwein, Essigindustrie	3638,5922
Wholesale Bottling	No equivalent	
Tobacco	Tabakindustrie	3638,5922
Chemical and Allied Trades	**Chemische und verwandte Industrien**	
Chemicals, Dyestuffs and Drugs	Chemische Grundstoffe, Farbstoffe,Pharmazeutika	3270, 5922
Fertiliser, Disinfectant, Glue, etc.	Düngemittel, Klebstoffe	3270,3276,5922
Soap, Candle and Perfumery	Seifen,Waschmittel,Kerzen,Kosmetische Industrie	3276,5922
Paint, Colour and Varnish	Farbenbindustrie,Harze,Lacke	3270,3276,5922
Seed Crushing	Öhlmühlen, Ölveredlungsindustrie	3276,3636,5922
Oil and Tallow	Talg,Schmalz,Abdeckereien,Knochenverwertung,Fischmehl- u.Tranfabriken	3636,5922,3276
Petroleum	Benzin,Mineralölderivate,mineralische/technische Öle und Fette	3276,3270,5922
Explosives and Fireworks	Sprengstoffindustrie,Zündstoffe,Sprengkapseln,Pyrotechn.u.Zündwarenind.	3270
Starch and Polishes	Stärke- und Stärkeveredelungsindustrie	5922,3638
Match	Zündholzindustrie	3273
Ink, Gum, and Typewriter Requisites	No equivalent	
Miscellaneous Trades	**Sonstige industrien**	
Rubber	Kautschukindustrie	3543
Scientific Instruments, Appliances and Apparatus	Opt.,fein-mediz.-mechan.Industr.,orthopäd.Erzeugn. hygien.Bandagen	5922,3546
Plastic Materials, Buttons and Fancy Articles	StempelapparateGummistempel, Waren aus chem.Kunstst.,Ind.Kunststoffe	3546,5922,3273,3270
Coke and By-Products	Kokereien	3545
Manufactured Fuel	Schwelereien,Montanwachs,Steinkohlenteerdestillation,Benzolreinigung	3276,3270,3545
Linoleum and Oilcloth	Linoleum,Wachstuch,Kunstleder	5922,3276
Musical Instruments	Harmonika, Orchesterinstrumente,Saiten,Sprechmaschinen,Schallpl.,Klavier, Orgel	5922,6017,3275,3273
Brush	Borsten,Faserstoff,Haarzurichtung,Bürsten,Pinsel	5922,3273
Games and Toys	Spielwaren,Christschmuck	5922,6017
Sports Requisites	No equivalent	
Manufactured Abrasives	Schleifmittel	5922,3279
Incandescent Mantles	Glühstrümpfe	5922,3275

Cinematograph Film Printing	Photochemische Industrie	
Clay and Building Materials Trades	**Baumaterialen und keramik**	
Brick and Fireclay	Ziegelindustrie,Kalksandsteinindustrie,feuer-u.säurefeste Erzeugnisse	5922,3279
China and Earthenware	Feinkeramik,Steinzeug	5922,3279
Glass	Glasindustrie(Hütten, Flach-Hohlglas -verarbeitung)	5922,5986,5987
Cement	Zementindustrie	5922,3279
Building Materials	Gips,Mörtel,Edelputz,Bimsbaust., Schlacke,Beton,Asb.zem.,Leichtb.pl.,etc.	5922,3279
Timber Trades	**Holz-und Möbel**	
Timber (Sawmilling, etc.)	Sägeindustrie	5922,3273
Furniture and Upholstery	Sperrholz,Möbel-Bauteile,Holzwaren,Holzmehl,Holzwolle	5922,3273
Coopering	Faßholzsägerei und Faßindustrie	5922,3273
Cane and Wicker Furniture and Basketware	Stuhlrohr,Korbwaren-möbel,Schilfrohr-Strohgewebe Flaschenhül.etc.,Kork	5922,3273
Wooden Crates, Cases, Boxes and Trunks	Kistenindustrie	5922,3273
Paper, Printing and Stationery Trades	**Papier und Druckgewerbe**	
Paper	Papier-,Pappen-,Zellstoff-,Holzstoffindustrie	5922,3277
Wallpaper	Tapetenindustrie	5922,3277
Printing, Bookbinding, Stereotyping, Engraving, etc.	Druckgewerbe,Chemigraphisches Gew.,Buchbindereien	5922,3277
Manufactured Stationery	Papierveredelungsindustrie,Papierwarenindustrie	5922,3277
Printing and Publication of Newspapers etc.	See Printing, bookbinding etc.	
Cardboard Box	Pappenverarbeitende Industrie	5922,3277
Pens, Pencils and Artists' Materials	Füllhalterindustrie,	5922,3275,3273

Sources: Board of Trade, *Final report on the Fifth Census of Production*
Bundesarchiv Berlin-Lichterfelde, BA R3102

Appendix 3. Values of output and unit value ratios. UK and Germany 1935-1936

*Source*s: see Appendix 1

Product Item	German value RM 1000	UK value £ 000	UVR RM/£	Product Item	German value RM 1000	UK value £ 000	UVR RM/£
Cotton yarn single	580,317	53,287	20.2	Sawing machines	34,420	87	14.2
Piece goods	977,585	53,638	25.4	Spinning machines	18,000	3,647	18.3
Worsted combed	413,667	28,769	21.9	Looms	13,318	746	17.3
Woollen carded	274,356	4,583	21.0	Bleach & dying	27,517	261	19.0
Woollen & worsted tissues	820,908	42,318	23.6	Sewing machines	63,351	1,159	13.4
Artificial silk	222,251	13,953	15.6	Laundering machines	26,660	1,069	12.8
Flax yarn	51,856	807	21.9	Reapers	78,074	72	15.3
Tow	5,152	453	22.0	Locomotives	69,551	1,885	20.4
Jute yarn	36,163	2,640	18.6	Heavy oil machines	25,783	2,750	20.6
Knitted fabric (wool)	41,759	5,413	15.8	Air & gas compressors	66,525	905	15.5
Stocking & Hose	267,546	16,066	19.5	Pumping machines	53,537	2,484	15.0
Gloves	47,266	297	18.6	Blast furnace plant	49,745	567	23.9
Packing and wrapping paper	703	644	19.9	Cranes	64,487	2,779	17.0
Yarns and cloth	2,372	291	15.0	Printing machines	49,897	1,096	16.7
Bends & bellies	151,708	7,534	29.0	Typewriters	58,115	384	13.1
Box sides	18,426	1,284	33.6	Grainmilling machines	31,152	350	17.2
Chrome tanned	32,921	273	31.0	Mining machines	35,695	1,997	12.7
Box & willow calf	73,522	550	29.0	Gas & chemical mach.	80,890	1,073	31.3
Harness & saddlery	17,147	14	19.6	Fractionalized power	13,194	703	17.9
Gloves	32,328	2,768	18.6	Generators	197,641	2,590	16.5
Men's overcoats	113,203	3,164	23.2	Converters/transformators	25,965	2,655	12.6
Dressing gowns	24,175	328	17.1	Vacuumcleaners	33,237	3,286	6.4
Aprons etc.	74,705	2,039	18.0	Wireless sets	106,548	10,463	13.6
Shirts	91,984	6,285	21.7	Bulbs	62,926	2,345	18.2
Shoes	543,218	37,619	24.0	Small bulbs	6,611	755	18.3
Basic/ forge	692,249	9,463	19.9	Lamps for motor vehicles	4,021	293	38.1
Foundry	54,531	4,840	14.9	Steamships	65,312	6,793	20.6
Acid steel	42,118	4,840	17.5	Engine-ships	89,943	5,939	14.6
Refined steel/ steel ingots	1,304,724	17,050	12.8	Cars	564,853	48,255	15.4
Plates & sheets	189,058	6,842	15.3	Motorcycles	82,122	2,216	15.5
Sheet bars	925,573	5,283	19.6	Goods vehicles	166,087	8,684	27.0
Railway wheels and axles	25,108	1,679	12.4	Chassis	182,220	10,383	23.6
Engineering castings	355,203	21,182	14.0	Trailers	65,235	576	26.9
Iron & steel pipes	66,247	7,122	14.0	Motor bodies	84,702	5,234	28.3
Steel castings	56,092	1,161	14.9	Bicycles	63,732	6,664	15.2
Cast iron	63,360	11,208	14.2	Engines	29,727	1,948	17.7
Stoves for cooking	17,790	371	10.4	Carriages	37,237	990	19.5
Tin boxes and containers	111,178	7,314	17.5	Wagons	23,706	755	26.4
Enamelled	51,712	1,400	15.1	Tramcars	2,097	217	8.7
Plows	4,343	88	6.8	Copper	27,283	2,870	14.6
Chain cables	11,379	279	13.3	Silver	39,524	8,215	12.3
Screws for wood	37,587	710	6.7	Gold	61,989	19,099	12.5
Coach screws	24,011	26	22.9	Zinc	1,602	737	12.5
Other railway materials	75,976	2,042	27.5	Tin ingots	6,278	7,607	12.0
Metal office furniture	41,345	1,071	11.5	Tin solder	3,253	1,605	11.6
Metal doors	73,356	180	11.8	Nickel	13,308	3,031	15.3
Cables & rope	37,353	2,815	15.0	Aluminium alloys	201,863	6,801	21.9
Barbed wire	16,963	450	12.6	Copper plates & tubes	120,000	6,206	15.4
Wire netting	39,627	756	16.8	Brass	210,088	10,150	15.5
Cut nails	34,942	300	17.7	Zinc products	23,677	1,778	12.5
Saws	15,034	833	9.0	Aluminium foil	23,349	771	17.4
Files & rasps	17,628	730	24.9	Aluminium castings	88,449	2,183	23.5
Locks, padlocks	23,687	1,149	13.7	Magnesium alloys	20,643	272	17.6
Builders iron mongery	36,070	620	22.0	Watches, complete	35,715	107	10.8
Cabinet makers goods	17,434	264	9.7	Wheat & barley	1,554,382	48,095	29.6
Boilers	4,116	2,082	16.0	Bread	256,971	55,700	21.5
Economisers	20,677	1,200	17.8	Biscuits	126,104	11,482	21.2
Boring/drilling machines	32,850	1,072	18.6	Cocoapowder	31,146	1,780	14.8
Lathes	140,142	1,866	19.1	Blockchocolate	157,313	8,192	24.4
Grinding machines	56,415	866	19.3	Chocolate confectionary	103,865	10,022	22.8
Presses/punching machines	30,341	803	18.0	Sugar confectionary	83,673	14,374	21.3

Product Item	German value RM 1000	UK value £ 000	UVR RM/£	Product Item	German value RM 1000	UK value £ 000	UVR RM/£
Marmelade & jams	89,253	7,062	16.7	Ochres and earth colours	1,389	329	8.7
Herrings	133,783	281	18.1	Litophone	16,492	538	16.6
Bacon	107,341	16,918	20.1	Cellulose varnishes	40,039	915	19.6
Ham	93,567	2,787	19.7	Varnishes and lacquers	80,794	3,303	11.6
Soups	31,376	729	20.7	Unrefined seed oil	72,944	2,988	22.7
Gravy salt	22,949	481	27.0	Unrefined nuts and kernels	141,292	2,920	19.2
Custard	59,585	1,247	19.1	Refined oils	145,913	7,230	15.8
Margarine	320,650	6,186	26.0	Motor spirit	125,026	4,374	24.6
Sugar unrefined	350,647	2,715	35.3	Petroleum	81,606	1,595	27.1
Sugar refined	673,696	31,152	31.2	Starch	50,976	743	10.5
Poultry foods	84,168	2,222	23.9	High explosives	25,015	1,770	15.1
Compound cake & meal	64,806	4,371	26.9	Matches	28,781	2,161	9.0
Beer	711,213	54,415	18.3	Cycle Rubber tyres	29,414	1,061	13.0
Malt	134,692	5,240	22.2	Motorcycle Rubber tyres	5,333	247	16.3
Cigarettes	655,083	42,633	35.1	Motorcar Rubber tyres	48,833	10,685	21.4
Cigars	321,230	438	22.6	Synthetic resins powder	14,819	928	15.1
Sulphuric acid	26,413	1,959	7.4	Coke	551,493	9,597	18.9
Hydrochloric acid	4,041	501	15.0	Coal tar	50,752	1,947	22.0
Sodium sulphate	3,849	224	13.6	Benzol crude	90,841	817	19.5
Formic acid	4,574	449	11.8	Piano's	6,791	1,242	24.7
Lactic acid	2,646	703	46.3	Bricks	266,870	15,376	13.8
Boric acid	2,526	217	17.4	Sand-lime	37,053	232	11.5
Citric acid	1,291	170	15.5	Firebricks	60,938	2,047	25.2
Nitric acid	17,453	237	9.8	Silica bricks	15,221	848	14.4
Sodium carbonate	45,737	5,565	14.0	Sanitary earthernware	96,022	1,466	18.2
Ammonium chloride	7,622	500	11.5	Electrical ware	13,628	895	19.2
Sodium hydroxide	19,580	1,521	7.3	Floor tiles	25,875	167	10.5
Potassium chloride	3,845	261	14.2	Wall tiles	32,288	668	11.9
Sodium cyanide	5,257	651	8.9	Globes	11,914	618	11.7
Methanol	12,281	221	14.2	Bottles for beer, wine etc.	29,058	2,067	16.9
Salicyd acid	1,938	158	12.1	Chemical bottles etc.	25,096	1,254	21.3
Camphor	7,316	34	11.9	Jars	16,096	2,039	18.9
Quinine	9,891	414	13.4	Cement	256,220	8,791	14.8
Aspirin	4,130	175	23.5	Newsprint	79,425	8,051	18.3
Menthol	187	18	19.5	Writing & printing paper	198,666	12,495	12.5
Extracts for tanning	3,581	6,110	19.9	Packing and wrapping pape	114,298	5,411	13.0
Ether	4,543	103	16.5	Cellulose wrapping paper	53,352	2,150	15.4
Formaldehyde	4,224	304	13.9	Cardboard uncoated	22,231	2,167	20.5
Celluloid	3,000	300	14.9	Paper hangings	26,950	3,251	12.0
Benzol refined	11,667	1,699	24.0	Coated paper	57,897	2,354	13.9
Blanc fixe	2,356	189	16.0	Parchment	12,566	443	21.7
Aluminium sulphate	7,868	376	20.0	Waxed paper	13,165	1,131	15.6
Coppersulphate	3,705	447	20.7	Pencils (lead)	17,871	401	13.8
Carbonic acid	8,832	281	26.3	Sawn and planed woods	547,776	12,575	10.2
Coal tar refined	9,527	1,168	21.2	Machine made casks	6,167	267	11.3
Pitch	24,839	600	21.5	Small barrels	13,725	121	10.1
Indigo	4,676	867	6.0				
Finished dyestuffs	238,000	3,996	26.7				
Ammonia	48,013	265	40.4				
Nitric acid	10,797	238	10.2				
Sodium nitrate	42,031	502	21.7				
Superphosphate	30,572	1,049	16.6				
Calciumcarbide	73,070	268	6.7				
Sulphate of ammonia	43,130	871	20.4				
Hard soap	55,086	6,544	18.4				
Toilet soap	49,792	2,473	17.1				
Soft soap	27,671	306	18.3				
Powder	143,905	3,439	17.8				
Toothpaste	21,306	1,492	9.8				
White lead	13,107	1,192	14.6				
Chemical colours	17,673	1,565	11.8				

Appendix 4. Values of intermediate inputs and unit value ratios. UK and Germany 1935-1936

Product Item	German value RM 1000	UK value £ 000	UVR RM/£	Product Item	German value RM 1000	UK value £ 000	UVR RM/£
Raw cotton and waste	410,189	39,728	16.1	Tin ore	2,385	6,747	7.1
Cotton yarn & artificial silk	47,463	8,416	14.9	Gold	1,610	39	14.1
Yarn	436,561	38,870	20.3	Silver	129	7	10.4
Tops	233,459	16,610	19.3	Wheat & barley	1,231,956	37,423	30.6
Wool	193,971	30,870	17.2	Lflour	131,377	18,780	22.6
Yarn	6,609	2,311	18.4	Sugar	112,975	3,443	38.7
Combed yarn	154,025	28,796	21.9	Raw cocoa	65,558	2,704	24.5
Carded yarn	90,294	4,583	21.0	Nuts	11,092	1,027	17.6
Yarn (continuous filament)	86,000	5,983	13.0	Wheat flour	12,000	1,442	22.6
Raw jute	34,045	2,696	18.7	Bacon and hams	255,300	7,152	16.3
Cotton yarn single	97,805	4,062	20.2	Herrings	35,541	2,143	21.0
Combed wool	94,930	8,479	21.9	Vegetable oils	91,718	2,036	18.8
Artificial silk single	82,150	3,197	19.8	Fish and animal oils	37,777	1,474	17.9
Raw and fiber asbestos	2,739	540	27.8	Milk	35,526	4,174	25.4
Native/Rind	56,032	3,293	19.8	Unrefined sugar	373,297	2,703	34.0
Calf skins	13,115	425	15.5	Wheat offals and oil seed ca	82,494	2,565	35.1
Box & willow calf	5,590	550	22.1	Barley	100,281	5,784	24.8
Whole skin	20,167	157	22.0	Malt	102,072	4,907	19.6
Box sides	13,474	1,284	26.2	Tobacco	289,824	13,900	30.6
Worsted	232,043	21,872	21.5	Nitric acid	1,729	238	6.6
Cotton	224,197	15,168	22.9	Sodium carbonate	615	505	18.2
Calf skins	11,692	141	23.6	Sodium hydroxide	427	49	7.8
Bellies & Shoulders	35,599	2,160	21.7	Sulphuric acid	2,632	73	8.9
Bends & butts	63,997	5,378	20.3	Sulphur	1,819	515	12.9
Box & willow calf	49,625	3,170	20.1	Sodiumsulphate	1,207	70	15.8
Other upper leather	27,751	2,489	24.0	Hydrochloric acid	1,141	96	7.8
Coke	219,491	6,368	18.9	Methanol	12,761	633	15.4
Ore	316,863	7,415	24.5	Benzol crude	55,627	657	21.1
Pig Iron	688,212	13,029	18.4	Toluol	11,281	66	22.4
Pig iron	89,882	5,134	15.2	Ammonia	44,562	441	45.0
Scrap & steel	68,987	1,676	15.8	Sulphuric acid	8,513	73	16.4
Tinplate bars	52,500	4,521	20.0	Potash salts	11,933	315	14.2
Iron & steel bars & rods	168,075	7,061	13.0	Tallow	6,334	1,127	20.0
Wire rods	104,033	3,372	14.2	Whale oil	6,594	569	20.8
Steel	5,130	1,474	13.5	Other hydrogenated fats	23,704	119	16.9
Steel	6,220	160	15.0	Caustic soda	10,659	352	9.8
Iron castings	323,933	5,481	18.5	Linseed oil	3,865	1,137	19.2
Steel castings	69,546	2,331	15.0	Resins	13,432	593	22.1
Iron/steel forgings	20,321	2,804	14.8	Turpentine substitutes	5,556	512	16.0
Bars & rods	117,413	3,223	17.1	Zinc oxide	3,737	292	25.3
Plates, sheets, strip	82,688	3,884	15.6	Seeds	108,454	7,741	18.9
Iron & steel castings	32,167	1,923	14.8	Nuts and kernels	138,869	4,478	15.1
Copper in all forms	58,161	7,159	16.5	Nitrate of ammonia	3,748	103	19.6
Brass	19,893	1,342	14.7	Crude rubber	38,983	4,785	17.4
Lead	22,832	2,054	17.0	Cotton yarn	18,196	1,758	15.0
Plates/sheets	34,845	2,054	15.6	Formaldehyde	5,610	338	16.7
Angles/sections	6,632	806	15.6	Coal	524,252	10,125	19.0
Sheets	20,364	3,228	19.7	Coal	71,461	4,236	19.0
Castings/ forgings	52,317	4,826	11.7	China clay	4,464	183	16.8
Aluminium	20,815	651	18.3	Other clay	2,472	223	12.3
Motor bodies	102,345	5,275	19.4	Sand	3,335	306	11.2
Car engines	13,179	2,425	25.8	Soda	13,159	710	19.8
Motorcycle engines	3,497	76	18.9	Chemical woodpulp	190,187	6,608	23.6
Motorcar tyres	32,584	8,000	12.4	Mechanical woodpulp	76,848	2,750	20.7
Steel bars & rods	6,307	130	12.4	Waste paper	38,824	1,001	22.3
Aluminium	51,993	571	20.0	Plain paper	7,500	665	16.7
Iron & steel	7,520	2,116	14.9	Paper & cardboard	96,586	5,128	16.9
Pig lead	27,475	3,281	15.1	Timber unsawn	337,360	10,810	6.0
Unwrought copper	62,169	4,300	15.8	Hardwood	115,396	2,628	10.8
Zinc ore	1,050	537	22.0	Panel wood	18,130	1,493	5.7
Aluminium unwrought	5,800	2,682	15.6	Hoop and strip	1,827	65	20.0

Sources: see Appendix 1

Appendix 5. Gross output, value added and intermediate input ppp per branch in manufacturing. UK and Germany 1935-1936

	Gross output PPP (RM/£)			Intermediate input PPP (RM/£)			Value added PPP (RM/£)			Value added -PPP as percentage of Gross output PPP
	Laspeyres	Paasche	Fisher	Laspeyres	Paasche	Fisher	Laspeyres	Paasche	Fisher	
Textile Trades	21.8	21.5	21.6	18.8	18.7	18.7	27.3	27.6	27.5	127
Leather Trades	28.6	27.9	28.2	21.8	21.9	21.8	43.6	43.6	43.6	155
Clothing Trades	22.0	21.5	21.7	21.7	21.7	21.7	22.3	21.2	21.8	100
Iron and Steel Trades	14.9	15.2	15.0	17.9	17.9	17.9	10.6	12.5	11.5	76
Engineering, Shipbuilding & Vehicles Trades	17.8	17.3	17.6	16.3	16.5	16.4	19.3	18.0	18.6	106
Non-Ferrous Metals Trades	14.6	16.3	15.4	12.4	15.1	13.7	20.2	19.3	19.8	128
Food, Drink and Tobacco Trades	24.3	24.5	24.4	26.3	26.5	26.4	21.0	21.9	21.4	88
Chemical and Allied Trades	17.2	16.3	16.7	18.7	18.4	18.6	15.4	14.3	14.8	89
Miscellaneous Trades	19.9	18.9	19.4	18.1	18.7	18.4	22.0	19.2	20.5	106
Clay and Building Materials Trades	16.0	15.3	15.6	18.3	18.3	18.3	14.7	14.3	14.5	92
Paper, Printing and Stationery Trades	14.8	14.1	14.5	21.5	21.6	21.6	10.5	10.6	10.5	73
Timber Trades	10.2	10.2	10.2	6.9	6.7	6.8	14.0	22.1	17.6	172
Total manufacturing	19.3	17.6	18.4	19.6	18.2	18.9	18.8	17.0	17.9	97

Note: The last column shows the ratio of the (Fisher) value added PPP to the (Fisher) gross output PPP.

Sources: Data from Appendix 1, 3 and 4

Appendix 6. The structure of value added and employment in manufacturing. UK and Germany 1935-1936

	Value added			Employment[a]		
	Germany in 1000RM	UK in 1000£	Germany as percentage of UK[b]	Germany	UK	Germany as percentage of UK
Textile Trades	2,831,552	157,503	65.5	906,187	1,054,860	85.9
Leather Trades	402,611	10,668	86.6	92,946	50,533	183.9
Clothing Trades	1,075,729	80,995	61.0	350,110	535,886	65.3
Iron and Steel Trades	4,114,457	116,508	308.7	950,573	539,270	176.3
Engineering, Shipbuilding &Vehicles Trades	6,177,892	249,322	133.1	1,385,384	1,104,363	125.4
Non-Ferrous Metals Trades	650,416	29,947	110.0	129,280	122,097	105.9
Food, Drink and Tobacco Trades	3,543,298	201,515	82.1	549,244	520,649	105.5
Chemical and Allied Trades	2,419,791	88,486	184.4	285,151	194,011	147.0
Miscellaneous Trades	1,254,199	43,703	140.2	270,713	182,619	148.2
Clay and Building Materials Trades	1,178,260	54,086	150.5	355,374	249,438	142.5
Paper, Printing and Stationery Trades	1,509,823	111,661	128.2	371,910	408,967	90.9
Timber Trades	952,451	37,268	149.3	323,009	194,894	165.7
Total manufacturing	26,110,479	1,181,662	123.6	5,969,881	5,157,587	115.7

Notes: [a] Numbers of people employed

[b] Ratio of value added in national currencies converted with (Fisher) value added PPPs from Appendix 5.

Sources: Data from Appendix 1 and 5.

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